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ELSAT® Series

L-Band Block Up-converter (BUC) Operating Manual

Ku-Band
SEKu-Band
EC-Band
SEC-Band

You have just received an ELSAT® Block Up-Converter, a *cost-effective* product with no compromise on *quality* and *reliability*. This product should provide tireless performance in any reasonable operating environment. Note that this product is transmit only, and does not include a Block Down-Converter, which will have to be obtained separately.

We, at ANACOM, have taken great care to provide a convenient, easy-to-use product in a single package. Should a situation arise beyond the operator's control, just give us a telephone call. Many situations can be diagnosed and solved by ANACOM's trained customer-service personnel over the phone.

If you have any questions, require technical assistance or training please call ANACOM directly at (408) 519-2062 or FAX to us at (408) 519.2063. You can also send e-mail to techsupport@anacominc.com and one of our engineers will contact you.

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Operating Manual
for the
ELSAT®-Series Block Up-Converter

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ELSAT® Quick Start Guide

1. Mount the Block Up-Converter (BUC) on the antenna.

2. Connect the required cables/waveguide.
   At a minimum, this includes a TX IF cable from the modem
   the RF output cable or waveguide to the antenna OMT TX

3. Install a proper power connector on the (included) power cable. Plug the cable into 110 or 240VAC, or optional 48VDC.

4. Configure the L-band Modem & verify the following outputs on the TX IF cable at the BUC:
   10 MHz reference: 0 to +10 dBm – if required
   Transmit IF power input: -15 dBm nominal for rated output. Set the modem power to achieve the required link budget.

5. Set Frequency of operation from the modem.
   EC-Band BUC: 4900 MHz L.O.
   950 MHz to 1525 MHz L-Band input → 5850 MHz to 6425 MHz C-Band output
   SEC-Band BUC: 4900 MHz L.O.
   950 MHz to 1750 MHz L-Band input → 5850 MHz to 6650 MHz C-Band output
   Standard Ku-Band BUC: 12800 MHz L.O.
   1200 MHz to 1700 MHz L-Band input → 14000 MHz to 14500 MHz Ku-Band output
   Extended Ku-Band BUC: 12800 MHz L.O.
   950 MHz to 1450 MHz L-Band input → 13750 MHz to 14250 MHz Ku-Band output
   Super Extended Ku-Band BUC: 12800 MHz L.O.
   950 MHz to 1700 MHz L-Band input → 13750 MHz to 14500 MHz Ku-Band output

Introduction

The ELSAT® VSAT series of block up-converters (BUC) are designed for continuous outdoor duty in all types of environments. Ideally suited for SCPC, MCPC, DAMA, and VoIP applications. Designed to interface with any L-band modem, the ELSAT® VSAT BUC may be used in a wide variety of communication networks.

The C-band members of the ELSAT® family transmit in the 6 GHz frequency range. The Ku-band members of the ELSAT® family transmit in the 14 GHz frequency band.

The ELSAT® VSAT BUCs include an L-band up-converter and a solid-state power amplifier (PA), into a small, highly integrated outdoor package. The only cabling required to the indoor plant are the IF and power cables.

The ELSAT® C-band BUC up-converts the modulator's L-band IF output to an RF signal in the 6 GHz range for transmission.

The ELSAT® Ku-band BUC up-converts the modulator's L-band IF output to an RF signal in the 14 GHz range for transmission.

The ELSAT BUC includes an L-band to RF up-converter, a solid-state Power Amplifier (PA), optional M&C, and a universal A.C. power supply, all in a simple outdoor package.

The Power Amplifier (PA) uses Internally-Matched Field-Effect Transistors (IMFET) to achieve highly linear power and gain with minimal intermodulation distortion (IMD) products.

ELSAT® uses a wide input voltage (100 to 240VAC, 47 to 63Hz) switching power supply to develop the +13V used as the internal power source for the power amplifier. An internal circuit senses the input voltage range being used and automatically switches to the appropriate voltage mode. The AC input is connected via a 4-pin circular connector. DC power supplies such as 48V are optional.

ELSAT® BUCs can come equipped with an internal 10 MHz reference. If this option is not present, a 10 MHz reference signal supplied on the TX IF cable from the modulator will be required.

Shown in Figure 1 below is a 20W ELSAT® Block Up-Converter.

Figure 1 - ELSAT Block Up-Converter

Typical Operating Parameters - ELSAT

C-Band			Ku-Band		
1 dB Compression Point and nominal gain	**10W**: 40 dBm	55 dB	1 dB Compression Point and nominal gain	**8W**: 39 dBm	54 dB
	20W: 43 dBm	58 dB		**16W**: 42 dBm	57 dB
	30W: 44.8 dBm	59.8 dB		**20W**: 43 dBm	58 dB
	40W: 46 dBm	61 dB		**23W**: 43.6 dBm	58.6 dB
	50W: 47 dBm	62 dB		**25W**: 44 dBm	59 dB
	60W: 47.8 dBm	62.8 dB		**40W**: 46 dBm	61 dB
	70W: 48.5 dBm	63.5 dB		**50W**: 47 dBm	62 dB
	80W: 49 dBm	64 dB		**60W**: 49 dBm	64 dB
	100W: 50 dBm	65 dB		**80W**: 49.75 dBm	64.75 dB
	125W: 51 dBm	66 dB		**100W**: 50 dBm	65 dB
	150W: 51.8 dBm	66.8 dB		**125W**: 51 dBm	66 dB
	180W: 52.6 dBm	67.6 dB			
	200W: 53 dBm	68 dB			
	400W: 56 dBm	71 dB			
TX Level Flatness		6dBp-p max / 500 MHz			
TX Input IF Frequency	EC BUC: 950 to 1,525 MHz SEC BUC: 950 to 1,750 MHz		TX Input IF Frequency	Ku BUC: 1,200 to 1,700 MHz Eku BUC: 950 to 1,450 MHz SEKu BUC: 950 to 1,700 MHz	
TX Input IF Impedance		Type N connector 50 Ω (75 Ω is optional)			
TX Input IF Level		-15 dBm for all models			
Transmit RF	EC BUC: 5.850 to 6.425 GHz SEC BUC: 5.850 to 6.650 GHz		Transmit RF	14.0 to 14.5 GHz	
CPR-137 Flange (Threaded & Grooved): 30W, 50W and higher N-Type Connector: 10W, 20W, 40W			WR-75 Flange (Threaded & Grooved) all power levels		
TX Phase Noise:		-60 dBc/Hz max. @ 100 Hz -70 dBc/Hz max. @ 1 KHz -80 dBc/Hz max. @ 10 KHz -90 dBc/Hz max. @ 100 MHz			
Spurious		-50 dBc max, + - 500 Hz: - 45 dBc			
Requirements for Optional Reference (Provided on TX IF line by modem if not installed in BUC)					
Frequency		10 MHz (sine-wave)			
Input Power		-5 to +5 dBm (at input port)			
Phase Noise:		-125 dBc/Hz max. @ 100 Hz -135 dBc/Hz max. @ 1 KHz -140 dBc/Hz max. @ 10 KHz			
Alarm Relay		FORM C for Summary Alarm; Isolated			
Temperature Range		-40C to +50C operational -40C to +75C storage			
Altitude		10,000 feet (3,048 meters) max			
Rain		20 inches per hour			
Wind		150 miles per hour			
Vibration		1.0 g random operational, 2.5 g random survival			
Shock		10 g operational, 40 g survival			
Power		100 to 250 VAC; 47 to 63 Hz			
Typical Power Consumption / Weight			Typical Power Consumption / Weight		
10W: 125VA / 32 lb. (15kg)	**70W**: 570VA / 57 lb. (27kg)		**8W**: 160VA / 28 lb. (13kg)	**40W**: 770VA / 67 lb. (31kg)	
20W: 230VA / 39 lb. (18kg)	**80W**: 570VA/ 60 lb. (28kg)		**16W**: 270VA / 37 lb. (17kg)	**50W**: 800VA / 67 lb. (31kg)	
30W: 280VA / 57 lb. (26kg)	**100W**: 760VA / 75 lb. (34kg)		**20W**: 290VA / 40 lb. (18kg)	**60W**: 850VA / 67 lb. (31kg)	
40W: 390VA / 45 lb. (21kg)	**125W**: 1070VA / 100 lb. (46kg)		**23W**: 300VA / 40 lb. (18kg)	**80W**: 1430VA / 125 lb. (57kg)	
50W: 390VA / 57 lb. (26kg)	**150W**: 1070VA / 100 lb. (46kg)		**25W**: 300VA / 40 lb. (18kg))	**100W**: 1600VA / 125 lb. (57kg)	
60W: 400VA / 57 lb. (26kg	**180W**: 1400VA / 134 lb. (61kg)			**125W**: 1640VA / 125 lb. (57kg)	
200W: 1400VA / 134 lb. (61kg)	**400W**: 2832VA / 280 lb. (127kg)				

Block Up-Converter Size		
10W	21.6" x 9" x 11.6"	(549 x 229 x 295 mm)
20W	21.6” x 9” x 13.5”	(549 x 229 x 343 mm)
40W	21.6" x 9" x 14"	(549 x 229 x 356 mm)
30, 50, 60, 70W	21.6" x 9" x 15"	(549 x 229 x 381 mm)
80W	21.6" x 9" x 16"	(549 x 229 x 407 mm)
100W	21.6" x 13" x 14"	(549 x 330 x 356 mm)
125,150,180,200W	38" x 13" x 12.5"	(965 x 330 x 381 mm)
400W	38” x 25.5” x 12.36”	(965 x 648 x 314 mm)

Block Up-Converter Size		
8W	21.6" x 9" x 11.6"	(549 x 229 x 295 mm)
16W, 20W, 23W, 25W	21.6” x 9” x 13”	(549 x 229 x 330 mm)
40W, 50W, 60W	21.6" x 13" x 13.6"	(549 x 330 x 353 mm)
80W, 100W, 125W	38” x 13” x 12.5”	(965 x 330 x 318 mm)

Installation

Removal of any cover may jeopardize the weather seal, which may cause problems later.

Unpacking

Check to make sure that the Block Up-Converter has not suffered any damage in shipment. Compare contents of the crate to ensure items received match those listed on the packing slip. Retain all shipping containers for future use.

Tools and Test Equipment

Have on-hand a standard electrician's tool kit and any tools listed in your antenna installation instructions.

Safety Precautions

General

Observe normal safety precautions when operating this equipment.

Ensure the ELSAT® Block Up-Converter is properly grounded. Do not rely on coaxial cable shields for the ground connection.

If the cover is removed from any ANACOM product, ensure that all:

- gaskets are intact and free of damage prior to reinstallation
- mounting screws are properly installed

Ensure all connectors are properly waterproofed.

Power Supply

Confirm that AC Power is disconnected before removing the Block Up-Converter cover.

Transmitter

Take adequate precautions to ensure the ELSAT® output does not transmit a signal until it has been properly connected and set up for authorized frequencies and power levels.

Transmitter RF output power levels are adequate to cause blindness or other serious injury to body tissues. Use caution when working around the Block Up-Converter or antenna when the system is active.

Power Amplifier

Be sure the Block Up-Converter TX OUT port is properly terminated prior to operation. Ensure all the correct waveguide gaskets are used to prevent water damage.

TO ENSURE PROTECTION OF PERSONNEL AND EQUIPMENT, USE CARE DURING ANTENNA INSTALLATION AND WHENEVER WORKING ON OR AROUND THE SYSTEM.

Site Considerations

The installation requirements of any particular site are the responsibility of the system operator. AnaCom offers an optional installation mounting kit, that can be used at most sites. Contact AnaCom for details.

Antenna

The Block Up-Converter must be attached to some form of mounting structure which is usually the antenna feed boom or the antenna support structure. Specific mounting procedures will depend on the antenna used. The ELSAT® Block Up-Converter is designed to be mounted on most antennas. Locate and install the antenna according to the antenna manufacturer's instructions. Choose an area that is free of extraneous interference from motors and electronic equipment and has a clear line-of-sight from the antenna to the satellite.

Lightning arrestors should be used at the site to protect personnel and equipment. Size 3/0 or 4/0 stranded copper wire should be used to bond the Block Up-Converter to the antenna frame and to the lightning protection ground rod.

Power Requirements

The ELSAT® BUC contains an internal universal AC power supply that supplies both the converter and PA internal subassemblies.

The ELSAT® BUC requires 110 VAC or 220 VAC at 50 or 60 Hz, through a circuit breaker. The size of the circuit breaker depends on model. To assure uninterrupted service, some method of back-up AC power is recommended. Installing surge arrestors and AC power line filters will reduce voltage surges from the AC power input. Provide an isolation filter to clean up power line interference and/or voltage variations, as required.

NOTE: AC TRANSIENTS AND SURGES MAY CAUSE DATA TRANSMISSION ERRORS AND LOSS OF SYNCHRONIZATION IN THE BLOCK UP-CONVERTER SYNTHESIZERS AND/OR THE EXTERNAL MODEM EQUIPMENT.

BUC Mounting Considerations

The ELSAT® BUC must be mounted such that:

1. Sufficient support is afforded the Block Up-Converter to minimize the effects of antenna sway in strong winds.
2. Air movement is possible across the heat sink fins.

NOTE: The length (and associated RF losses) of the interconnecting cables must be considered when determining the location of the ELSAT® Block Up-Converter.

BUC Mounting

The ELSAT® Block Up-Converter is designed for mounting in any position. For optimal heat sink action, the heat sink fins should be vertical, or as nearly vertical as is practical. For Block Up-Converters equipped with a fan, this suggestion does not apply.

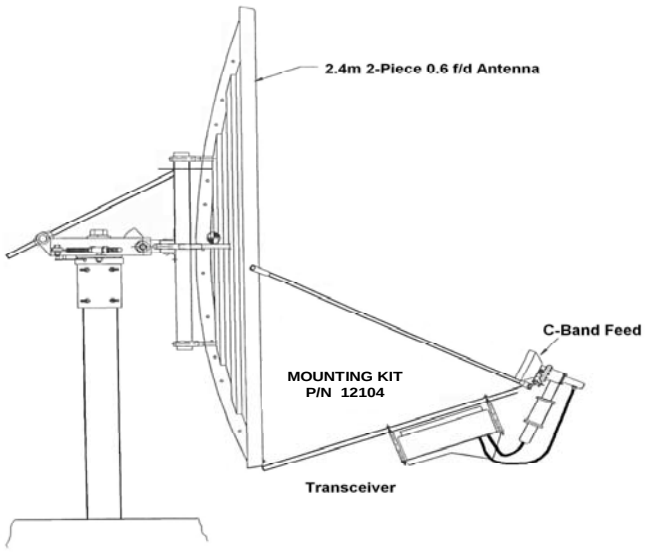


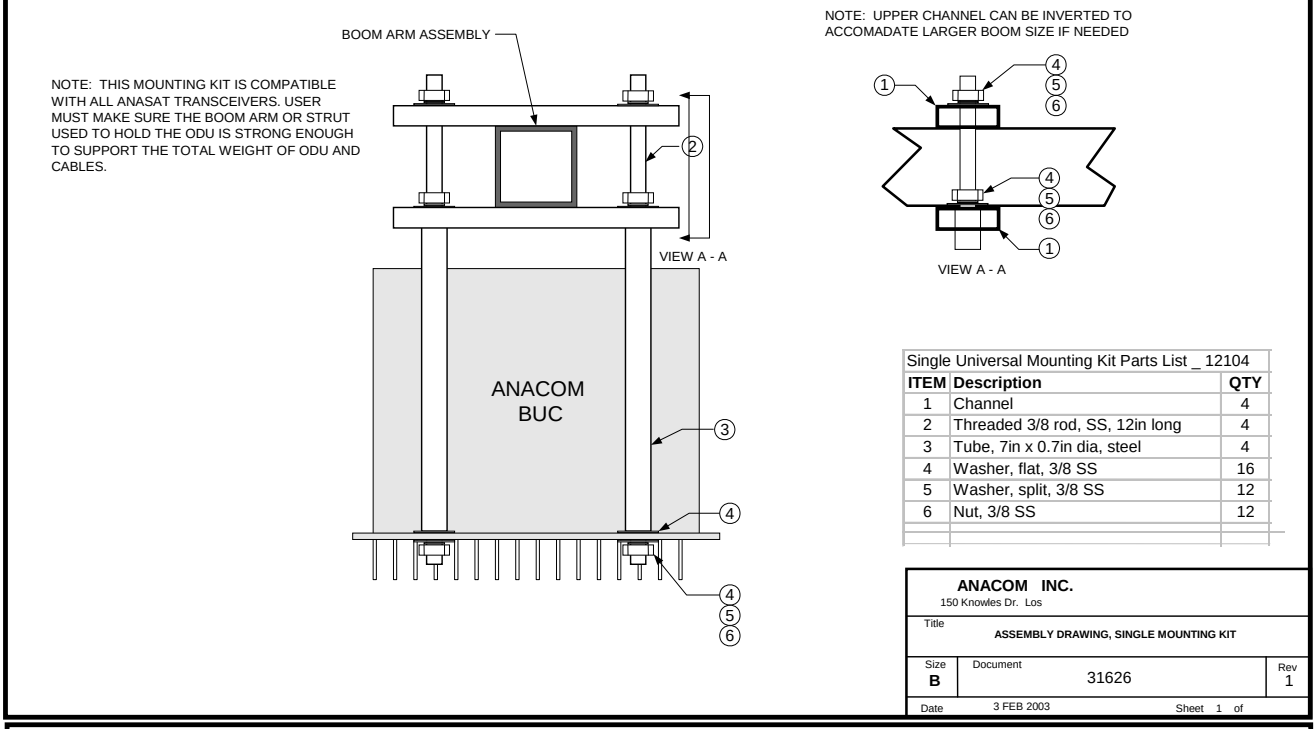
Figure 2 - Typical BUC Mounting

When mounting the BUC, allow enough room to adjust the antenna's azimuth and elevation. Throughout installation and during any polarization, azimuth, or elevation adjustment, ensure the cables and waveguide are not crimped or pinched.

Grounding

Electrical bonding (grounding) of the BUC is required to prevent possible damage from lightning or other induced electrical surges.

The BUC is provided with both an M3, and a #8 ground point. It is recommended that 000 AWG minimum copper wire or copper braid be used to bond this unit to the earth ground (grounding rod) using the most direct (shortest) route possible.


BOOM ARM ASSEMBLY
NOTE: THIS MOUNTING KIT IS COMPATIBLE WITH ALL ANASAT TRANSCEIVERS. USER MUST MAKE SURE THE BOOM ARM OR STRUT USED TO HOLD THE ODU IS STRONG ENOUGH TO SUPPORT THE TOTAL WEIGHT OF ODU AND CABLES.
VIEW A - A
ANACOM
BUC
NOTE: UPPER CHANNEL CAN BE INVERTED TO ACCOMADATE LARGER BOOM SIZE IF NEEDED
VIEW A - A

Single Universal Mounting Kit Parts List _ 12104		
ITEM	**Description**	**QTY**
1	Channel	4
2	Threaded 3/8 rod, SS, 12in long	4
3	Tube, 7in x 0.7in dia, steel	4
4	Washer, flat, 3/8 SS	16
5	Washer, split, 3/8 SS	12
6	Nut, 3/8 SS	12

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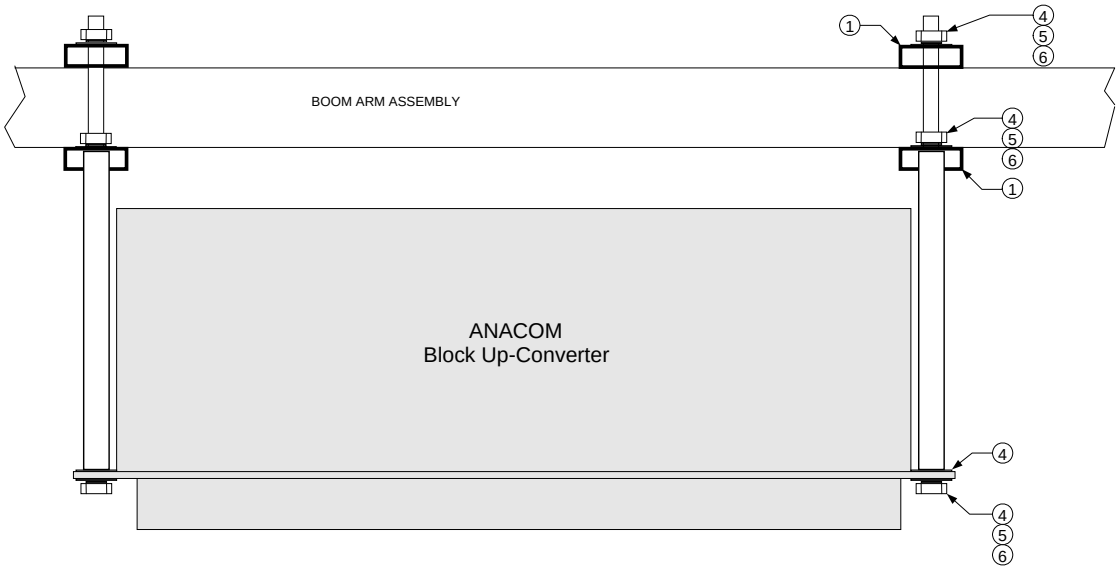
Title: **ASSEMBLY DRAWING, SINGLE MOUNTING KIT**

Size	Document	Rev
B	31626	1

Date: 3 FEB 2003 Sheet 1 of



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Title: **ASSEMBLY DRAWING, SINGLE MOUNTING KIT**

Size	Document Number	Rev
B	31626	1

Date: 3 FEB 2003 Sheet 2 of 2

Figure 3 - Front and Side Views of Mounted BUC

Cable and Waveguide Connections

Cabling Requirements

Local regulations may require that cables in occupied buildings be installed in steel conduit. Local government agencies may waive this requirement for the use of Plenum cables, which are standard cables entirely encased in solid Teflon. Check the codes in your area.

NOTE: EQUIPMENT OUTAGES DUE TO FAULTY CABLE MATERIALS OR INSTALLATION ARE NOT COVERED BY YOUR WARRANTY.

1. AC Power

Attach the AC input cable to the 4-pin connector on the Block Up-Converter, shown in Figure 4. Run the AC cable to the power source *but do not attach*. The supplied power cable has a four-pin weather-tight circular connector attached to one end. The other end is terminated with flying leads. Attach the proper AC power connector for your location to the other end of this cable as shown in Figure 5.

Color code:
Brown.....AC Hot power lead
Blue.....AC Neutral power lead
Green/Yellow..... Ground

Figure 4 - AC Power Connection

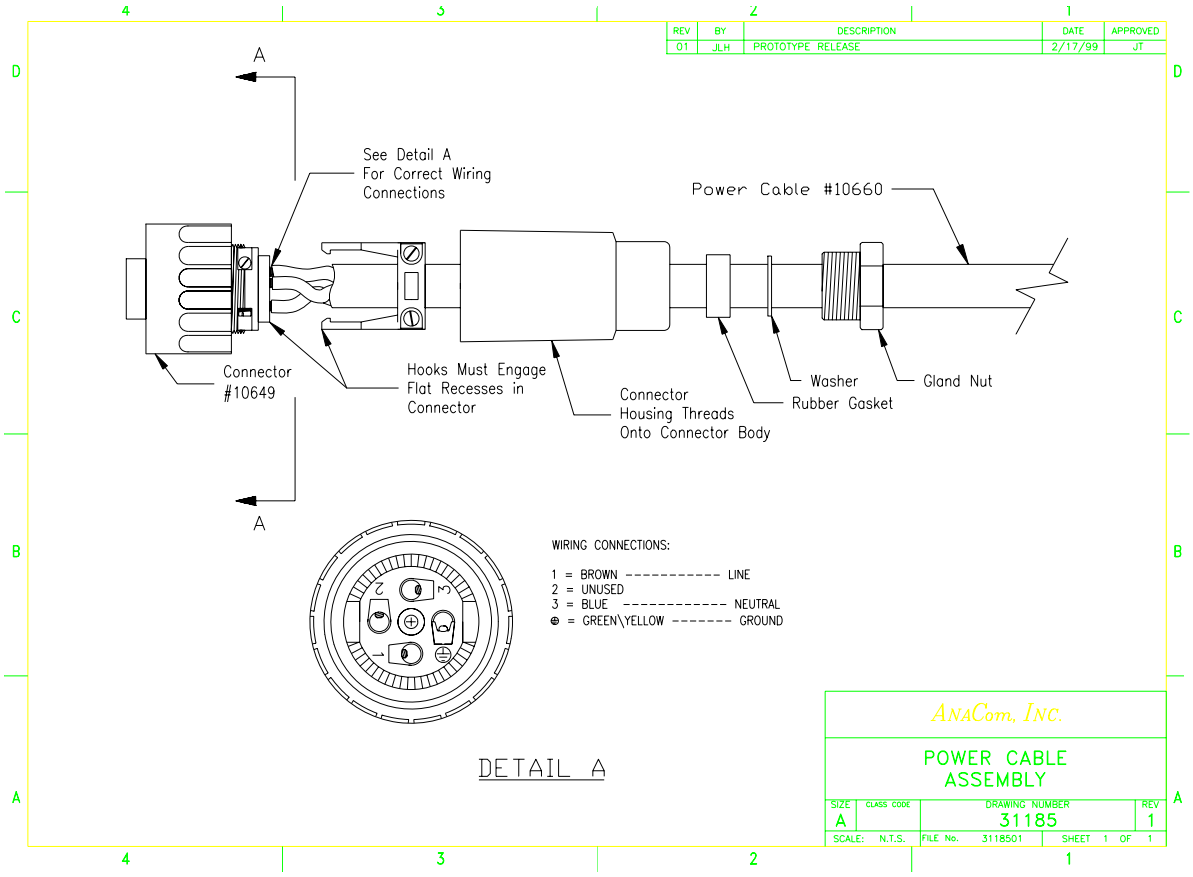

REV | BY | DESCRIPTION | DATE | APPROVED
01 | JLH | PROTOTYPE RELEASE | 2/17/99 | JT
See Detail A For Correct Wiring Connections
Power Cable #10660
Connector #10649
Hooks Must Engage Flat Recesses in Connector
Connector Housing Threads Onto Connector Body
Washer
Rubber Gasket
Gland Nut
WIRING CONNECTIONS:
1 = BROWN ---------- LINE
2 = UNUSED
3 = BLUE ---------- NEUTRAL
⏚ = GREEN\YELLOW ------- GROUND
DETAIL A
ANACOM, INC.
POWER CABLE ASSEMBLY
SIZE A | CLASS CODE | DRAWING NUMBER 31185 | REV 1
SCALE: N.T.S. | FILE No. 3118501 | SHEET 1 OF 1

Figure 5 - Diagram of AC power cable

2. *Transmitter Feed*

If using a BUC with an N-type connector output, connect a section of coax between the OMT transmit port and the BUC's transmit port.

If using a BUC with a waveguide flange output port, connect a section of waveguide between the OMT transmit port and the BUC's transmit output, TX OUT. A waveguide should be attached to the antenna feed per manufacturer's instructions. Ensure a gasket is fitted at each flange and that the connections are weather-tight.

3. *L-Band Modem*

Attach a coaxial cable with male N-connectors between the Block Up-Converter's TX IF input and the modulator IF OUTPUT. Make sure that the connections are weather-tight.

If the BUC was ordered without an internal 10 MHz reference, then the L-Band modem is required to provide, in addition to the L-Band IF signal, a 10 MHz reference signal. See **Typical Operating Parameters** for the requirements of the reference source. Note that the accuracy and transmitted phase noise is directly dependent on the external reference. Be sure the IFL cable is well shielded from external interference.

Final Check

Recheck all bolts and cabling.

After all other connections have been made (TX IF, TX output, and grounding), connect the AC power cord to an active outlet.

Water Resistance Wrap

The application of moisture-resistant wrap ***(mastic tape)*** to all connectors is recommended to prevent water entry and resultant water damage. See Figure 6. Apply the mastic tape as follows:

1. Ensure that all connectors are tight.
2. Pre-cut the mastic tape to the desired size.
3. Center the tape on the connector to be sealed and wrap the tape tightly around the connector. Squeeze the tape tightly and ensure that both ends of the tape have formed around the connector and the cable.
4. Apply the mastic tape to all connectors that may be exposed to moisture.

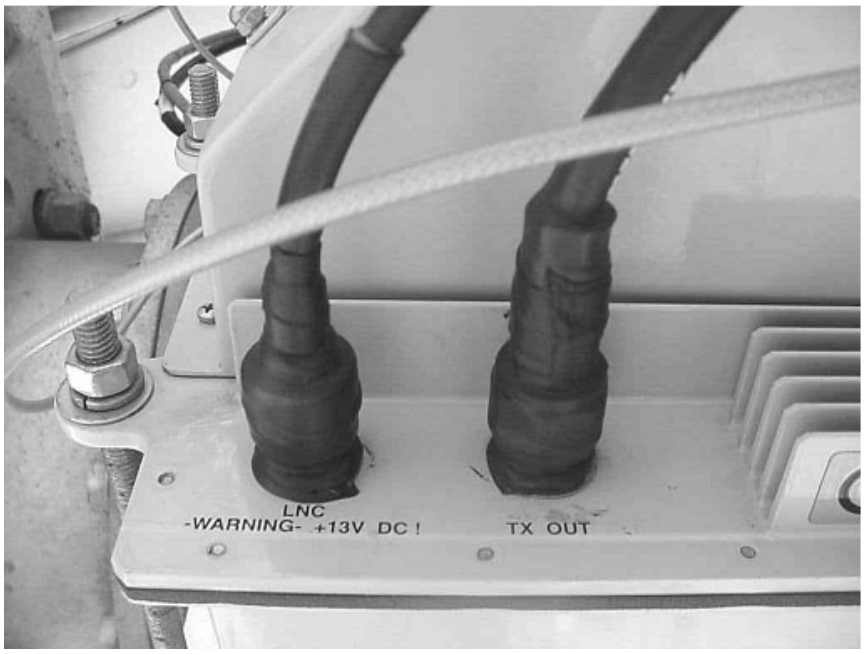


Figure 6 - Mastic Tape Application

Operation

After the ELSAT® hardware is mounted and verified, the antenna must be aimed toward the desired satellite. Follow the antenna/mount manufacturer's instructions, using coordinates provided by the satellite operator. Do not transmit until you have received authorization from the satellite network operation center, and a transmit power level from its engineering staff.

ELSAT Block Up-Converter will produce RF output power the moment a modulator is connected and provides input.

Frequency Programming

Transmit operating frequency for standard C-Band frequencies is calculated with the following formula:

f_{TX} = TX IF_{IN} + 4900 MHz (where TX IF_{IN} ranges over 950 MHz to 1750 MHz)

Transmit operating frequency for standard Ku-Band frequencies is calculated with the following formula:

f_{TX} = TX IF_{IN} + 12800 MHz (where TX IF_{IN} ranges over 950 MHz to 1700 MHz)

Antenna Adjustment

Do not transmit while adjusting the antenna position.

Follow the antenna manufacturer's instructions for antenna position adjustment. For final alignment, contact the satellite operator and get the correct polarization, azimuth, and elevation of the satellite and also confirm the desired transponder is operational.

Transmit Power Adjustment

Maintaining proper output power is vital for maximizing signal-to-noise ratios over the radio path. Low power levels produce noisy signals; excessive power robs downlink strength from other stations sharing the transponder.

Adjust the modulator output level to attain the desired output power level. Use a calibrated watt meter on the output of the Block Up-Converter for this task.

When transmitting multiple carriers, run the output power with an output level back-off sufficient to meet the spectral density mask requirements.

Caution: It is recommended that the Block Up-Converter PA not be driven into saturation for long periods of time.

Maintenance

ELSAT® Block Up-Converters are designed for a minimum of maintenance. Periodic scheduled maintenance is not required. Replacement of the weatherized fan after 7 years is recommended however.

Fan Replacement

WARNING !

The ducted fan shroud should NEVER be removed from the ODU while AC power is connected to the ODU. Disconnect AC power before replacing fan.

Some units come with a weatherized fan and ducted fan shroud assembly that is attached to the PA heatsink, and is outside the block up-converter enclosure. It is fairly easy to remove the shroud from the heatsink in order to replace the fan.

Figure 7 - Fan shroud removed from ODU

Figure 8 - Underside of fan shroud

The fan comes with a cable and three-prong connector. After the housing has been removed the heatsink, the old fan can be unplugged from the block up-converter heatsink and then removed from the shroud. A replacement fan available from AnaCom, Inc., can then be mounted on the shroud and it's connector plugged into the receptacle on the heatsink. The shroud can then be re-attached to the heatsink using the original screws.

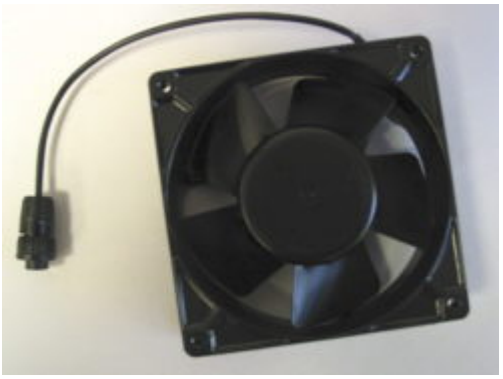


Figure 9 - Integrated fan and cable assembly

Alarm Relay Closure Option

If this option is installed, a mechanical relay is used in the ELSAT® BUC for alarm indication. The red LED mounted on the BUC is illuminated whenever a problem exists and the relay has closed.

The alarm relay has normally closed contacts, so it defaults to the alarm state when power is off.

Monitored Values

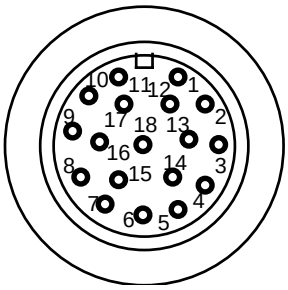
The following internal points are monitored and can result in Alarm closure if out of range:

- PA temperature
- -5V DC supply (used as a bias voltage in the power amp stages)
- Each individual PA power supply
- Main +13V DC supply
- Synthesizer Lock detect
- Cooling fan failure (on units equipped with a fan)

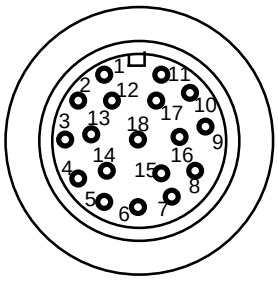
18-Pin Circular Weathertight Connector

An 18-pin circular connector is used for monitoring the alarm C-Form relay. Only some of the pins are used, but the same connector is used to maintain consistency with the protection switch used in the AnaSat® product line. If the optional M&C serial port function is installed, see the AnaSat user manual for pin definitions and serial control commands.

Note dimple next to Pin 1



Cable End View



Cable Wire View

Pin	Signal	Description
4	NO	Alarm Normally Open
5	NC	Alarm Normally Closed
6	C	Alarm Common
7	P13V	+13V CD Power (powers protection switch)
13	Mute	Ground to turn off the TX output
18	Ground	

The *Cable End View* refers to looking into the end of the connecting cable; the *Cable Wire View* refers to looking into the connector on the BUC.

LIMITED WARRANTY

If this product should fail due to defects in materials or workmanship, AnaCom, Inc., will, at its sole option, repair or replace it with new or rebuilt parts free of charge for a period of two (2) years from the date of shipment from the AnaCom factory. This warranty covers only failures due to defects in materials and workmanship that occurs during the period of the warranty. It does not cover damage that occurs during shipment, failure caused by operation of the product outside the published electrical or environmental specifications, or malfunctions caused by misuse of the product. Expendable components are not covered under this warranty.

In order for the customer to exercise their rights to repairs under the warranty, the customer must first contact AnaCom to obtain a repair authorization number (RMA). If it is necessary to return the product for repair, the customer is responsible for paying the cost of shipping it to AnaCom. AnaCom will pay the cost of shipping the product back to the customer when the repairs are completed. All import duties, customs fees, taxes of any kind, or any related fees are the sole responsibility of the customer.

Spare parts, repairs, or replacements are warranted to be free from defects in material or workmanship for ninety (90) days or the remainder of the limited warranty period, whichever is longer.

There are no express or implied warranties except as listed above. In no event shall AnaCom be liable for special, incidental, or consequential damages arising from the use of this product, or arising out of any breach of this warranty. All express and implied warranties, including the warranties of merchantability and fitness for a particular purpose, are limited to the applicable warranty period set forth above. No employee or representative of AnaCom is authorized to modify this warranty or AnaCom's standard warranty for any product.

Non-warranty repair service is available from AnaCom for a nominal charge. Non-warranty repair service can be obtained by contacting AnaCom and requesting a return authorization number (RMA), as described above. The customer is responsible for paying the cost of the shipping to and from AnaCom for any non-warranty repairs. Non-warranty repair service will be available for any AnaCom product for a minimum of five years from the date of its first shipment from AnaCom's factory.